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THIN-FILM CAPACITOR INTEGRATED CIRCUIT

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THIN-FILM CAPACITOR INTEGRATED CIRCUIT

[Hakumaku kondensa shuseki kairo]

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[There are no amendments to this patent.]

Claim

A type of thin-film capacitor integrated circuit characterized by the following facts: the main electroconductive body of the opposite electrode separated from the thin-film electrode supported on a nonconductive substrate by means of a dielectric film prepared by partial anodizing; said thin-film electrode is formed with an aluminum thin film; on the opposite electrode formed from said aluminum thin film, the lead-out electrode is connected via a through-hole on the insulating protective film that covers the capacitor; by means of said lead-out electrode, the through hole is covered.

Detailed explanation of the invention

The present invention pertains to a type of thin-film capacitor integrated circuit.

Figure 1 is a cross-sectional view illustrating the thin-film capacitor integrated circuit in the prior art. A portion of tantalum nitride film (3) on thermal oxide film (2) formed as a layer on substrate (1) is anodized to form tantalum pentaoxide film (4). On its surface, nickel film (5) is applied on tantalum nitride film (3). On its upper surface, gold film (6) is applied to form opposite electrode A. Said lead-out electrode B is composed of tantalum nitride film (3) formed as a layer below tantalum pentaoxide film (4), nickel film (5) formed as a layer on its upper surface just as explained above, as well as chromium film (8), nickel film (9), gold film (10), and bumps (11). That is, tantalum pentaoxide film (4) is a dielectric; tantalum nitride (3) below tantalum pentaoxide is the lower electrode; and nickel film (5), gold film (6), and chromium films (7), (8) are opposite electrodes.

Gold film (6) in opposite electrode A is adopted in consideration of its electroconductivity, corrosion resistance, and oxidation resistance in the stabilized heat treatment step of the operation. Gold film (10) in lead-out electrode B is adopted in consideration of its oxidation resistance in the heat treatment step and soldering affinity. However, for said film constitution, as noble metal is used, the cost is high. This is undesirable. Consequently, there is a demand on development of a new product with lower cost while the reliability is maintained.

The purpose of this invention is to provide a type of thin-film capacitor integrated circuit that has a lower cost and is free of the aforementioned disadvantages of the prior art.

According to this invention, by setting an insulating protective film that covers the capacitor, among the materials for the opposite electrode, the main electroconductive body is made of inexpensive aluminum film, and said through hole is covered with the lead-out electrode that is connected to the aluminum film via a through hole on the protective film. As a result, no expensive noble metal is used in this constitution.

In the following, an explanation will be given for an application example of the thin-film capacitor integrated circuit of this invention with reference to Figure 2.

As shown in the figure, (1) represents a glazed ceramic substrate. After a tantalum film is formed as thermal oxide film (2) by means of sputtering on the substrate, tantalum nitride film (3) as the electrode material below the capacitor is formed by means of active sputtering. After a portion of tantalum nitride film (3) is removed by means of photoetching, a portion is anodized to form tantalum pentaoxide film (4). The aforementioned steps of operation are the same as those in the prior art.

According to this invention, for the electroconductive film of opposite electrode A, instead of vapor deposition of nickel film (5), gold film (6), and chromium film (7) as would be performed in the prior art, nichrom film (5) and aluminum film (12) are formed by means of planar magnetron sputtering, and at the same time, on polyimide film (13) covering aluminum film (12), through holes (14) are formed for connecting opposite electrode A composed of

nichrom film (5) and aluminum film (12), and lead-out electrode B composed of chromium film (8), nickel (8), and solder bumps (11). Then, like in the prior art, patterning is performed by means of photoetching of the opposite electrode, and metal mask vapor deposition is performed for chromium film (8) and nickel film (9) for the lead-out electrode. However, gold film (10) for preventing oxidation of the lead-out electrode film is not used in this case. Also, polyimide film (13) for insulation protection not only can protect the opposite electrode made of aluminum film, but also has the effect of preventing flow of solder bumps (11). Consequently, there is no need to apply chromium film (7) that would be needed in the prior art for preventing flow of solder bumps (11). In addition, because the thermal history of the curing step of the polyimide film has an effect as a stability treatment step for the capacitor, there is no need to arrange a specific stability treatment step.

As chromium film (8) and nickel film (9) for the lead-out electrode cover through hole (14), aluminum film (12) is not exposed, and the corrosion resistance can be maintained.

As explained above, for the thin-film capacitor integrated circuit of this invention, an aluminum thin film is used as the main electroconductive body of the opposite electrode of the capacitor, and the through hole is covered with the lead-out electrode connected to the opposite electrode via the through hole formed on the polyimide film for insulation protection. By means of this constitution, no noble metal is used, and only ordinary metal materials are used. Consequently, it is possible to provide functional low-priced integrated circuits.

Brief description of the figures

Figure 1 is a cross-sectional view illustrating the thin-film capacitor integrated circuit of the prior art. Figure 2 is a cross-sectional view of the thin-film capacitor integrated circuit of this invention.

1	Substrate
2	Thermal oxide film
3	Tantalum nitride film
5	Nickel film
8	Chromium film
9	Nickel film
11	Solder bump
12	Aluminum film
13	Polyimide film
14	Through-hole
A	Opposite electrode

B Lead-out electrode

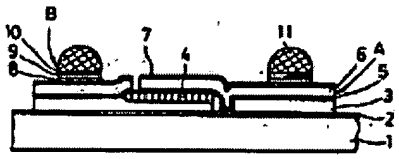

Figure 1

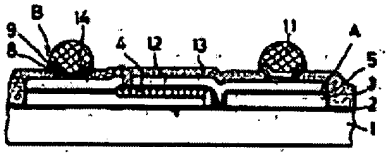

Figure 2